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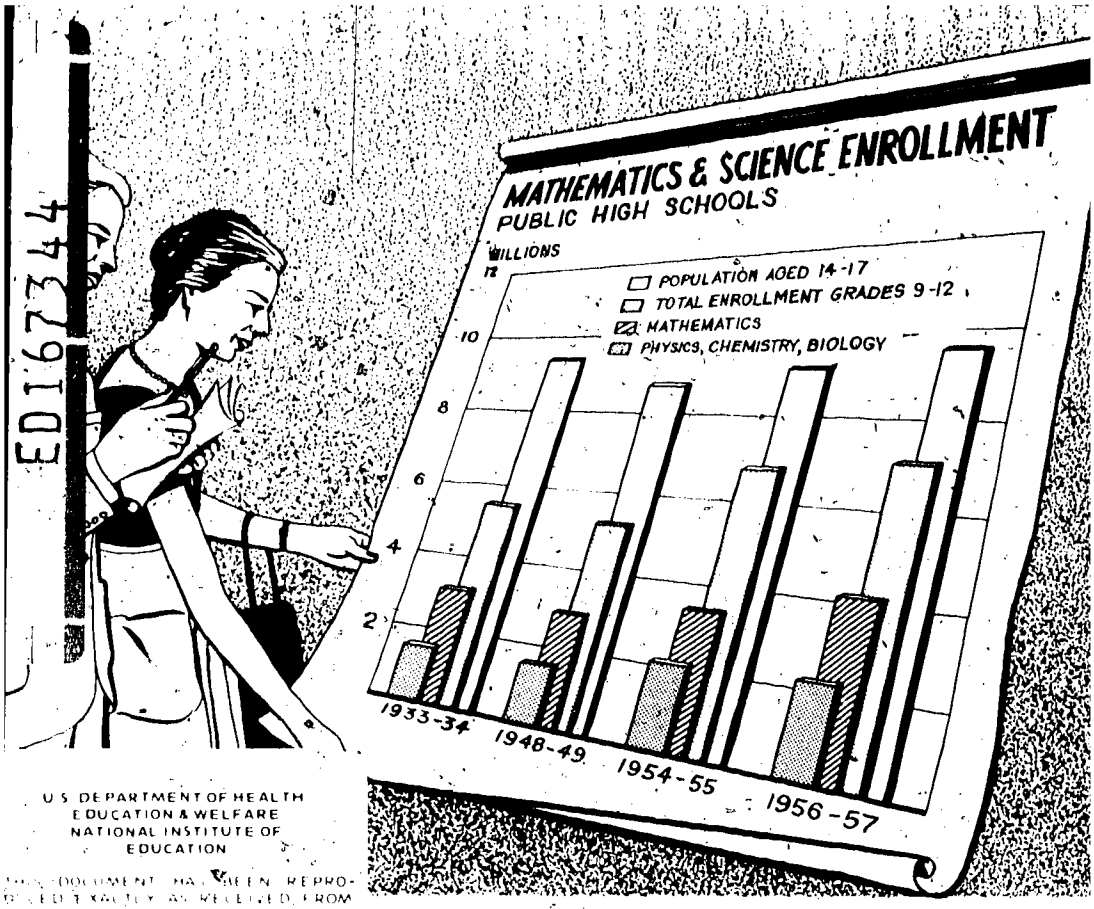
ABSTRACT

This study provides data on the offerings and enrollment in science and mathematics in public high schools during the fall of 1956. The information was obtained from a 10% sample of these schools selected at random. The same schools were used for a similar survey in 1954 and the data in that survey are compared with the data in the 1956 survey. The document reports the number and percent of schools offering various mathematics and science courses and the number and percent of pupils enrolled in these courses. It also reports the size of science and mathematics classes, ratio of boys to girls in science and mathematics courses, characteristics of the sample and national generalizations. Many tables and diagrams are also included. (HM)



Offerings *and* Enrollments in SCIENCE and MATHEMATICS *in* PUBLIC HIGH SCHOOLS

1956

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

Facts about Enrollments in High School Science and Mathematics

1. Between 1954 and 1956 the percentage of 11th grade pupils taking chemistry and 12th grade pupils taking physics increased.
2. The number and percentage of pupils enrolled in college preparatory mathematics increased from 1954 to 1956.
3. Between 1900 and 1956 the percentage of total high school students taking physics declined from 19 to 4.4, but during the same period the number increased from 98,846 to 309,600.
4. In 1956, of all pupils enrolled in the 12th grade of public high schools, 95.2 percent could have taken physics or chemistry. In other words, only 4.8 percent did not have access to such a course.
5. Two-fifths of the high school pupils took plane geometry, a course usually required for college entrance.
6. One hundred thousand high school seniors were in schools offering no advanced high school mathematics.
7. Ninety percent of the 10th grade pupils in the South Atlantic region took biology, but only 64.7 in the Pacific Coast region.
8. The percentage of pupils enrolled in certain mathematics courses in one region was five times the percentage in another region.
9. Four times as many boys as girls took 12th grade mathematics.
10. The number of schools offering neither physics nor chemistry has declined.

PAMPHLET NO. 120

Offerings *and* Enrollments in SCIENCE and MATHEMATICS *in* PUBLIC HIGH SCHOOLS

by KENNETH E. BROWN, Specialist for Mathematics
and
ELLSWORTH S. OBOURN, Specialist for Science
assisted by MARGUERITE KLUTTZ

1956

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
MARION B. FOLSOM . . . . . *Secretary*
Office of Education . . . . . LAWRENCE G. DERTHICK, *Commissioner*

"As our society depends increasingly on science and technology, it is important that all citizens have an understanding of the nature of science and mathematics. The continued security and growth of the United States in this age of technology require steady increases for many years to come in the Nation's supply of high quality engineers, scientists, and teachers of mathematics and the sciences."

—THE PRESIDENT'S NATIONAL COMMITTEE
FOR THE
DEVELOPMENT OF SCIENTISTS AND ENGINEERS
in
Improving Science and Mathematics Education

UNITED STATES
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Foreword

THE CONTINUING SHORTAGE of scientists, engineers, and technicians in the United States has increased the national interest in the potential supply of such manpower. An adequate reservoir of trained scientific personnel can be obtained only as young people are interested at an early age in science and mathematics and take continuing courses in them.

The education of a scientist cannot await the student's college years. It must begin at least in high school. It is therefore important to study high school offerings and enrollments in science and mathematics as a key to the Nation's future pool of scientific personnel.

Among other questions the following have been asked about high school science and mathematics:

1. To what extent do high schools offer courses essential for pupil development in mathematics and science?
2. Is the number taking mathematics and science adequate to meet the Nation's future demands?
3. To what extent are girls pursuing courses in science and mathematics?
4. What trends are evident in the various science and mathematics course enrollments?
5. What variations are there in science and mathematics courses among different types of high schools?
6. How do enrollments in mathematics courses vary from region to region?
7. Does the size of the classes lend itself to individualized or small group instruction?

To seek answers to these and similar questions the Office of Education has made studies of science and mathematics offerings and enrollments. The first study in 1954 appeared as Pamphlet 118 and the second in 1956 is incorporated in the present pamphlet.

E. GLENN FEATHERSTON,
Acting Assistant Commissioner,
Division of State and Local School Systems.

J. DAN HULL, *Director,*
Instruction, Organization, and Services Branch.

Offerings and Enrollments in Science and Mathematics in Public High Schools

Introduction

The need for specialized personnel in science and mathematics in the United States has focused attention on the potential supply of workers in these fields and on better methods of developing these workers. Public interest is evidenced by the many articles that appear in the press, the grants that organizations have made to improve mathematics and science education and in other ways. A single organization, The National Science Foundation, supported 96 summer institutes in 1957 and 16 academic year institutes in 1957–58, for science and mathematics teachers.

The Phelps-Stokes Foundation sponsored a 5-year project in four southern States for the improvement of science and mathematics instruction. The American Association for the Advancement of Science, Science Service (through its Science Clubs of America, National Science Talent Search, and National Science Fairs), the National Science Teachers Association (together with its Future Scientists of America Foundation), and the National Council of Teachers of Mathematics, have all been especially active in projects for developing our potential scientists.

Industry has contributed liberally to the support of summer science and mathematics conferences as well as to other educational projects. These are only a few examples of the present interest in developing our national science potential.

Do the present shortage of specialized personnel and the attempts at improvement indicate that the schools have neglected to train students in science and mathematics? Some persons, in their concern for producing more scientists and engineers, have stated: "Fewer pupils take science and mathematics today than 50 years ago," and "Our schools are not doing a good job of teaching mathematics and science."

For several years, the percentage of pupils enrolled in certain science and mathematics courses declined. The present study shows that between 1954 and 1956, *both percentage and numbers* increased. During 1956–57 more pupils enrolled in high school science and mathematics than during any previous year in the history of our Nation.

If more pupils are taking science and mathematics, why is there a concern about the shortage of specialized personnel in these areas? Is the quality of instruction inferior in science and mathematics? Perhaps the very excellence of the product which the high schools have produced has contributed to the shortage. The scientists who were trained in our Nation's schools invented and developed machines that require more specialized personnel to maintain them. From our schools have come the engineers who developed this machine age—the very machines that require more specialized personnel and the invention of more machines.

No single cause seems to account for the shortage of scientists and mathematicians. Many factors have contributed to the shortage, among them a period of low birth rate. Our rapid expansion of technology has increased the need for scientific manpower. The demand for unskilled labor has rapidly declined while the demand for skilled labor has risen in our industrialized society.

In addition to the increased demand for specialized personnel to raise our standard of living, there are military demands. The world is engaged in an international conflict—a conflict of ideas—and, whether we like it or not, we are in a race with the Communists for technological supremacy.

The struggle for the freedoms we so fondly cherish may be won or lost in the laboratory. If we are to meet the obligations imposed by the cold war, if advances in medicine, the humanities, and the sciences are to continue at the present rate, then the supply of specialists must expand. Although more pupils are studying mathematics and science today than at any time in the previous history of our public schools, yet the number seems to be insufficient to meet the demands.

How many schools provide opportunities for all pupils to develop their potentials in mathematics and science? What proportion of our youth take science and mathematics? Are girls developing their abilities in these areas? How does the number of pupils taking science and mathematics compare with the number in 1954? These and kindred questions are the subject of this study.

Overview

This study provides data on the offerings and enrollments in science and mathematics in public high schools during the fall of 1956. The information was obtained from a 10-percent sample of these schools selected at random. The same schools were used for a similar survey in 1954 and the data in that survey are now compared with the data in the 1956 survey. Characteristics of the sample are described on pages 40–41.

This study reports the number and percent of schools offering various mathematics and science courses and the number and percent of pupils enrolled in these courses. It points out certain erroneous public statements on high school science and mathematics course offerings and shows some of the reasons for these errors and misinterpretations. For example, one statement says, "Only a third of the high schools offer trigonometry." Should a person conclude that two-thirds of our youth do not have an opportunity to take trigonometry? Certainly not, because the high schools that do not offer trigonometry are small ones, with small enrollments.

"Only 13.6 percent of the pupils in the last 4 years of high school are taking geometry." Does this mean that 86 percent of the high school graduates never study plane geometry? *It does not.* First, the geometry to which the statement refers includes both plane geometry and solid geometry. Second, the percentage is based on the number in the last 4 years of high school and not on the number of the graduates. If the percentage of pupils in the last 4 years of high school studying plane geometry in any year is approximately 25, it would mean that all pupils study it, since plane geometry is usually offered to only the 10th grade pupils (who constitute approximately 25 percent of the number of pupils in the last 4 years of high school). Perhaps this base (the total number of pupils in the last 4 years of high school) has contributed to many misinterpretations.

It may be clearer to report enrollments in terms of the percentage of pupils in the grade where the course is normally offered. In this case, the base is the number of pupils in the grade rather than the total number in the high school. For example, in 1956, the number of pupils studying trigonometry was 9.2 percent of the number of 12th grade pupils—the grade in which the course is usually offered. Based on the total number of pupils in grades 9 through 12, the figure would be 2.9 percent, which could be misinterpreted. This study presents the data both ways and compares them with the 1954 data.

Based on the grade where the course is usually offered, the percentages of enrollments in certain science and mathematics courses in the fall of 1956 were as follows: [1]

[1] For other science or mathematics courses, see pages 12 and 31.

1. Enrollment in biology equaled 75.5 percent of the number of pupils in the 10th grade; in 1954 the figure was 72.6 percent.

2. Enrollment in chemistry equaled 34.6 percent of the number of pupils in the 11th grade; in 1954 the figure was 31.9 percent.

3. Enrollment in physics equaled 24.3 percent of the number of pupils in the 12th grade; in 1954 the figure was 23.5 percent.

4. Enrollment in plane geometry equaled 41.6 percent of the number of pupils in the 10th grade; in 1954 the figure was 37.4 percent.

5. Enrollments in intermediate algebra equaled 32.2 percent of the number of pupils in the 11th grade; in 1954 the figure was 28.5 percent.

This study also reveals the change in the percentage of schools offering the various mathematics and science courses. For example, in 1956:

1. Of those schools with 10th grade pupils, 90.3 percent offered biology; in 1954 the figure was 89 percent.

2. Of those schools with 12th grade pupils, 18.2 percent offered neither chemistry nor physics; in 1954 the figure was 23 percent.

3. Of those schools with 10th grade pupils, 81.2 percent offered plane geometry; in 1954 the figure was 78 percent.

It should be pointed out that enrollments in schools that do not offer advanced science and mathematics courses are usually small. These data are given on pages 15 and 24.

This study shows that the average class size is slowly increasing. The large classes are in the 9th grade. These large classes make individual attention, at a time when high school pupils need it most, difficult if not impossible. Also unequal teacher loads and unequal educational opportunities for pupils are revealed by the variation in enrollments, offerings, and class size among geographic regions.

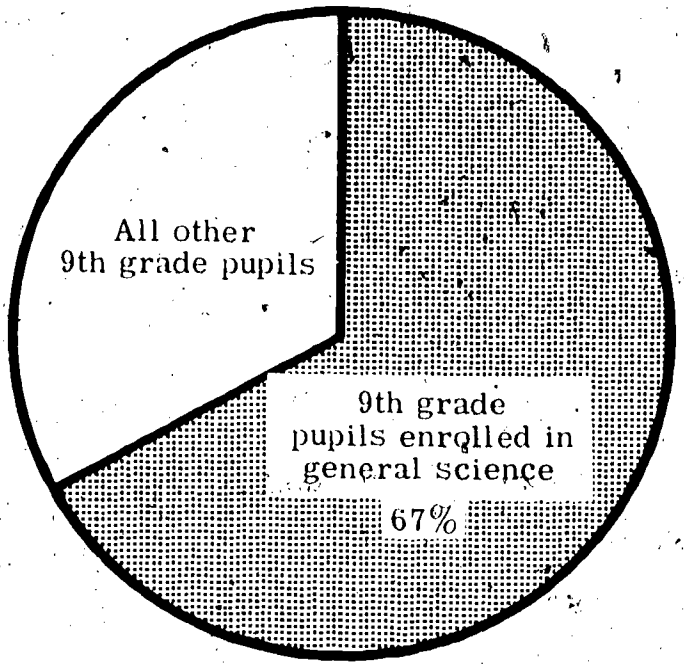
Schools Offering Science

The 1954 study of offerings and enrollments included the science offerings in the last 3 years of the secondary school. In this study general science at the 9th grade level in all types of schools has been added.

This study shows that 85.3 percent of schools of all types which enrolled pupils in the 9th grade offered general science. The percentage of schools that enrolled 10th grade pupils and offered biology as a science increased slightly from 89 percenr in 1954 to 90.3 percent in 1956. For schools enrolling 11th grade pupils and offering chemistry, there was an increase from 57 percent in 1954 to 63.8 percent in 1956. For schools enrolling 12th grade pupils and offering physics, there was an increase from 52 percent in 1954 to 56.8 percent in 1956.

The range in the percentage of schools of various types that enrolled 9th grade pupils and offered general science was about 10. For undivided high schools it was 79.8 percent of the schools, for junior-senior high schools 83.8 percent, for regular 4-year high schools 85.1 percent.

The schools that did not offer biology were, in general, small ones. They enrolled only 3.3 percent of all 10th grade pupils. However, their average 10th grade class size was 34.3. This condition did not change markedly between 1954 and 1956.



Percent of 9th grade pupils in general science: Fall 1956

In this study, 1,636 schools had pupils enrolled in first year biology. This was 90.3 percent of the schools that had 10th grade pupils. Of these 1,636 schools, 1,145, or 70 percent, offered biology to only 10th grade pupils; 386, or 23.6 percent, offered it to multigrades; and approximately 100 schools, or 6.4 percent, offered it either to 9th grade pupils only or to 11th grade pupils only.

Of the schools with 11th grade pupils, 37.1 percent offered chemistry as an 11th grade subject only, while 62.9 percent offered it in more than one grade. Physics was taught in 48 percent of the schools as a 12th grade subject, and in 52 percent it was offered on more than one grade level.

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The percentage of schools which offered chemistry in the fall of 1956 was about 7.0 percent greater than those that offered physics. About 63.8 percent offered chemistry and about 56.8 percent, physics. Some used the plan of alternating between the two. (In such cases, schools with small enrollments sometimes offer chemistry to both 11th and 12th grade pupils in a given year and then offer physics to a similarly combined group the following year. Thus, a pupil can get both subjects but it is necessary for the school to offer only one of the two courses in a given year.)

The 1954 study of offerings and enrollments showed that 23 percent of the schools offered neither physics nor chemistry and that, on the average, these schools had a 12th grade enrollment of only about 17 pupils, and contained only 5.8 percent of all 12th grade pupils in public high schools. The 1956 study shows a decline in the percentage of schools which offer neither physics nor chemistry to 18.2 percent. These schools had an average 12th grade enrollment of 18.6 and contained 4.8 percent of all pupils enrolled in the 12th grade. This means that, of all pupils enrolled in the 12th grade of the public high schools, 95.2 percent could have taken physics or chemistry and only 4.8 percent did not have access to these courses. This is about one percent less than for 1954.

TABLE 1.—Percentage of schools offering certain science courses: Fall 1954 and fall 1956

Courses	Percent of schools offering courses									
	All high schools		Regular 4-year high school		Senior high school		Junior-senior high school		Undivided high school	
	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11
General science		85.3		85.1		89.7		83.8		79.8
Biology	89	90.3	85	87.7	96	97.1	94	94.4	85	87.0
Chemistry	57	63.8	51	56.8	93	92.5	69	70.7	50	54.4
Physics	52	56.8	44	47.9	91	91.9	67	65.6	43	45.4
Neither physics nor chemistry	23	18.2	30	24.9	1	9	12	10.8	26	21.9

Table 1 shows the percentage of schools, by type, offering certain science courses in the fall of 1954 and the fall of 1956. For all schools there has

been an increase in the percentage offering the three specialized sciences, biology, physics, and chemistry. The largest percentage gains in these offerings, 6.8 for chemistry and 4.8 for physics, are in those courses about which there has been greatest concern.

Table 2 shows a distribution by region of the number and percentage of schools having the 12th grade which offer neither physics nor chemistry and the number and percent of pupils affected in each region. The wide variations from region to region might raise some questions about science offerings. Why, for example, in the West North Central, the East South Central, and the West South Central regions should there be such a high percentage of schools having the 12th grade which offer neither physics nor chemistry?

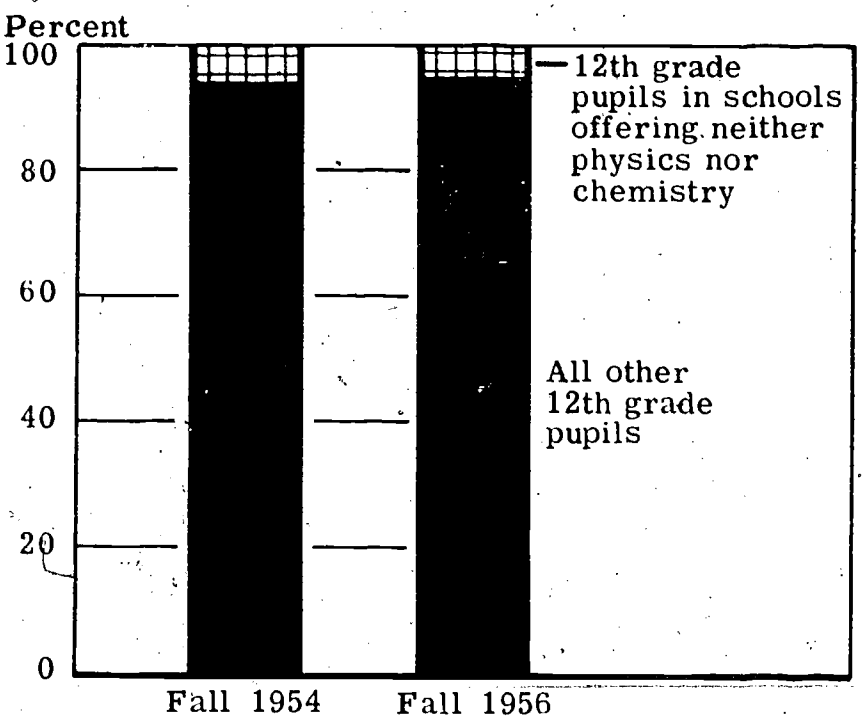
This study shows that public high schools offer not only general science, biology, chemistry, and physics, but also advanced general science, and other elective advanced science courses. In the sample, approximately 6 percent of the schools having the 12th grade offered advanced general science and 14.5 percent offered other elective advanced science courses.

About half of the schools in the study offered advanced general science as a 12th grade course only and the other half offered it as a multigrade course. Of the schools offering other sciences, 30 percent made these courses available in the 12th grade and 56.8 percent made them multigrade offerings.

TABLE 2. Number and percentage of schools, by geographic region, having the 12th grade but offering neither chemistry nor physics, and number and percentage of pupils affected: Fall 1956

Geographic region [1]		Schools		Pupils	
No.	Name	Number	Percent	Number	Percent
1	2	3	4	5	6
1	New England	0	0.0	0	0.0
2	Middle Atlantic	5	2.8	205	1.3
3	East North Central	25	7.7	416	1.6
4	West North Central	99	27.9	1404	9.7
5	South Atlantic	31	12.1	821	4.6
6	East South Central	39	25.2	961	1.3
7	West South Central	106	40.9	1933	15.0
8	Mountain	11	12.8	125	2.5
9	Pacific	7	8.1	98	0.8

[1] For identification of States comprising each region, see table 24, p. 42.



Percent of 12th grade pupils in schools offering neither physics nor chemistry: Fall 1954 and Fall 1956

Enrollments in Science Courses

Table 3 shows the percentage of pupils in the last 4 years of public high schools who have been enrolled in certain science courses from 1890 to 1956. These percentages are based on the total high school enrollment. General science and biology, the newer courses in the usual high school sequence, have shown an almost steady growth in percentage enrollment since their inception in the first 2 decades of the present century. On the other hand, of the two older sciences, chemistry has remained about constant percentagewise, while physics has declined steadily from 22.8 percent in 1890 to 4.6 percent in 1954 and 4.4 percent in 1956.

In terms of the total high school population, general science enrolls more pupils than any other science. General science is most commonly offered and required as a 9th grade subject. It appears as a multigrade offering in only about 8 percent of the schools. Some of these schools, usually the smaller ones, alternate general science with biology in the 9th and 10th grades in much the same manner that physics and chemistry are sometimes alternated in the later grades.

TABLE 3.—Percentage of pupils in the last 4 years of public high schools in certain science courses: 1890 to 1956–57

Year	Percent of pupils				Year	Percent of pupils			
	General science	Biology	Chemistry	Physics		General science	Biology	Chemistry	Physics
1	2	3	4	5	1	2	3	4	5
1890 [1]	.....	.....	10.1	22.8	1928	17.5	13.6	7.1	6.8
1900	.....	.....	7.7	19.0	1934	17.8	14.6	7.6	6.3
1910	.....	1.1	6.9	14.6	1949	20.8	18.4	7.6	5.4
1915	.....	6.9	7.4	14.2	1954 [2]	.....	19.6	7.3	4.6
1922	18.3	8.8	7.4	8.9	1956 [3]	21.8	20.5	7.5	4.4

[1] Biennial Survey of Education in the United States, 1948–50, chapter 5, Offerings and Enrollments in High School Subjects, 1948–49, p. 107, table 7. Washington: U. S. Government Printing Office, 1951.

[2] Brown, Kenneth E. Offerings and Enrollments in Science and Mathematics in Public High Schools, Pamphlet No. 118, p. 11, table 5. Washington: U. S. Government Printing Office, 1956.

[3] Estimates based on this study.

Since biology replaced botany and zoology in the high school sequence, it has shown a steady increase in the percentage of public high school pupils which it enrolls. This increase has been at the expense of enrollments in zoology, botany, and physiology. In 1910 the percent of pupils in the last 4 years of high school who were taking biology was 1.1, and by 1954 had increased to 19.6. The present study reveals a further growth in the past 2 years to 20.5 percent. Biology, most commonly offered as a 10th grade course, appears as a multigrade offering in only about 8.9 percent of the schools.

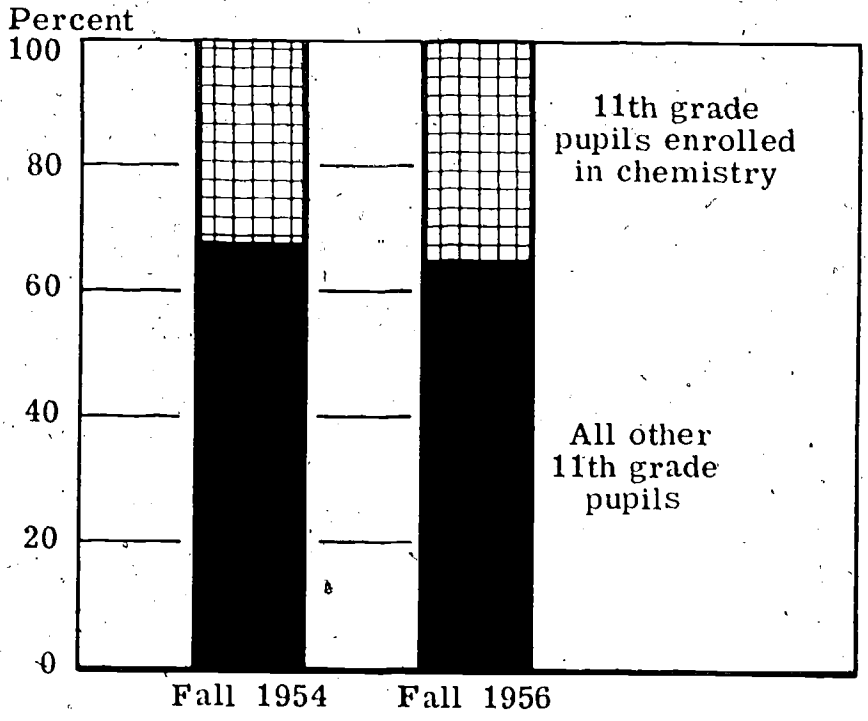
In 1900, 7.7 percent of the public high school population was enrolled in chemistry. Since that time, the enrollment in this subject has, for the most part, remained nearly constant at about 7.5 percent of the total high school enrollment. Care needs to be exercised in the use of this statistic since on first glance it would appear that chemistry as a science in the public high school has made little or no progress in terms of enrollment since the turn of the century. In fact, misleading conclusions of this sort have been drawn.

Close scrutiny of these data reveals that, while the percentage of high school students enrolled in chemistry has remained quite constant over more than a half century, the *actual* enrollment has increased nearly 13-fold or from 40,084 in 1900 to an estimated 519,900 on the basis of this study.

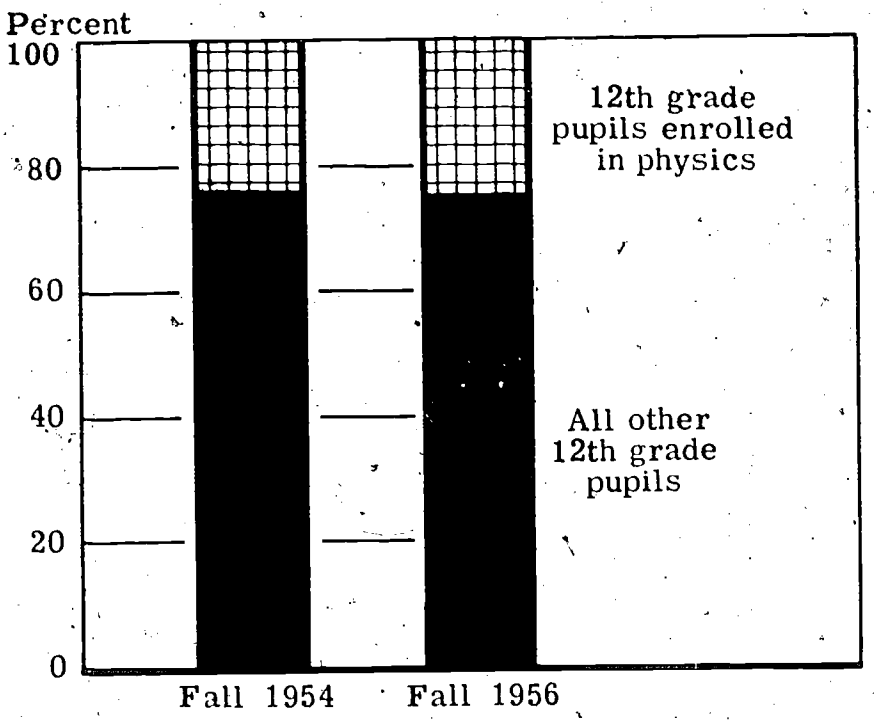
Chemistry appears to be offered as a multigrade subject more frequently than as an 11th grade offering.

The steady decline in the percentage of public high school pupils taking physics, which has been in effect since 1900, is further revealed by the present study. The 1954 study of enrollments revealed that the percentage enrollment had dropped to 4.6 percent and this study shows a decline to 4.4 percent.

This steady decline in percentage enrollment over the past half-century and more should be interpreted with caution and a full understanding of the facts. It in no way should be interpreted, as has been the case with previous statistics, to indicate a decline in enrollment in the subject. In 1900, for example, 19 percent of the pupils enrolled in the last 4 years of public high school were enrolled in physics. The actual number reported was 98,846. At that time physics was a 10th grade subject and usually required of all. In 1954, the percent had dropped to 4.6 but the number of pupils enrolled had increased to 302,800. The 1956 study shows a further decline to 4.4 percent of the total high school population and yet in the



Percent of 11th grade pupils in chemistry: Fall 1954 and Fall 1956



Percent of 12th grade pupils in physics: Fall 1954 and Fall 1956

period from 1954 to 1956, the number enrolled, it is estimated, has increased to about 309,600. During the 56-year period from 1900, the percentage enrollment has decreased from 19 to 4.4 but the actual numbers enrolled have more than tripled.

The number of 12th grade pupils enrolled in 1956 was 18.8 percent of the total enrollments in the last 4 years of the high school. The 4.4 percent therefore indicates that the number enrolled in physics at that time was equal to about one-fourth of the pupils in the 12th grade—the grade in which physics is usually offered.

Advanced general science enrolls approximately 1.2 percent of the total high school population or 6.1 percent of all the pupils enrolled in the 12th grade. The data do not seem to indicate that this course is widely accepted. By region, the course appears to have its heaviest enrollment in the Middle Atlantic, East North Central, and West North Central areas.

Enrollment in sciences other than those specified above and offered as a part of the curriculum in the public high schools attract about 2.7 percent of the total high school population, grades 9 through 12. An estimate for the Nation as a whole, based on the sample used in this study, is 188,000

pupils in grades 9 through 12 enrolled in sciences other than those which constitute the commonly accepted sequence. This study makes no attempt to identify these as specific sciences. It is quite reasonable to assume that they range over a wide variety of specialized courses.

TABLE 4.—Enrollments, by type of school, in certain science courses expressed as percent of pupils in grade where course is usually offered: Fall 1954 and fall 1956

Course	Grade level	Percent of pupils									
		All high schools		Regular 4-year high school		Senior high school		Junior-senior high school		Undivided high school	
		1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12
General science	9	.....	67.0	.....	70.0	.....	.....	.....	70.2	.....	73.5
Biology	10	72.6	75.5	72.5	76.2	69.6	69.7	72.7	81.0	76.5	78.9
Chemistry	11	31.9	34.6	32.1	33.5	30.7	36.2	32.5	35.1	30.6	32.9
Physics	12	23.5	24.3	24.1	21.7	20.0	26.1	24.9	26.0	22.9	21.3

Table 4 shows a comparison of science enrollments for 1954 and 1956, based on the number of pupils in the grade where the course is usually offered. Comparative data were not available for general science since this subject was not included in the 1954 study. The data indicate that for regular 4-year high schools, 70 percent of all 9th grade pupils are enrolled in general science. The same percent is enrolled in junior-senior high schools, and a slightly higher percent (73.5), prevails for general science in the undivided schools. The 67 percent shown in column 4 includes all schools used in the study. The biology enrollments in all the schools in the study are equal to 75.5 percent of the pupils enrolled in the 10th grade. The percent has increased from 72.6 to 75.5 since 1954.

The data for chemistry and physics are interpreted in a similar manner. The number of pupils enrolled in chemistry in all schools in this study is equal to 34.6 percent of the pupils in the 11th grade, the grade where chemistry is most commonly taken. The enrollment in physics for all schools in the study is 24.3 percent of the number of pupils enrolled in the 12th grade, the grade where that subject is most commonly taken.

Physics was the only science in which gains in percentage enrollment by type of school were not consistent. In senior and junior-senior high schools, physics showed substantial gains, at the same time showing percentage losses in enrollment in the other types of schools. When all schools in the study are considered irrespective of type, percentage gains for 1956 over 1954 appear for each of the specialized high school sciences.

Table 5 shows a comparison for 1954 and 1956, by geographic region, of the percentage of pupils enrolled in certain science courses. Again in this table, data are shown for general science only in 1956 since the subject was not included in the 1954 study. This table should be interpreted as follows: In Region 2 (Middle Atlantic) the number of pupils enrolled in chemistry in 1954 was 39.8 percent of the pupils in the 11th grade; for the same region in 1956, the number was 41.8 percent.

Table 5 shows some interesting patterns of variation in percentage enrollments, both from one science subject to another and from region to region. Generally, the pattern shows a trend toward increased percentage enrollments in all sciences. The range in percentage enrollments in the various sciences from region to region raises some significant questions. The range for general science is from 90.6 in the Middle Atlantic region to 43.9 in the Pacific. Why should the percentage in the former be twice that in the latter?

Although the range in percentage enrollment in biology, from one region to another, is not so great as for general science, it is greater than for either chemistry or physics. The range is from 90.0 percent in the South Atlantic region to 64.7 percent in the Pacific. What are the factors causing 90 percent of 10th grade pupils in the South Atlantic region to enroll in biology as compared with only 64.7 percent in the Pacific region?

For chemistry, the range in percentage enrollments is from 41.8 in the Middle Atlantic region to 28.2 in the West South Central region. For physics, it is from 36.2 in the Middle Atlantic region to 13.5 in the West South Central region. Again it may be asked: What factors are at work in the Middle Atlantic States to cause more than two and a half times the percentage of pupils to take physics in the 12th grade than in the West South Central States? For each of the ranges mentioned above, the higher percentage enrollment comes from an Eastern region while the lower percentage comes from a Western region.

Although substantial gains of 9.2 and 4.6 in percentage enrollments in biology and chemistry, respectively, were made in the West South Central region, the percentage enrollment in physics in the same region increased only 0.7 percent between 1954 and 1956. This West South Central region has twice as many high schools as the New England region and enrolls one-third more pupils, but graduates only about two-thirds as many pupils who have had a course in physics.

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TABLE 5.—Enrollments, by geographic region, in certain science courses expressed as the percentage of pupils in grade where course is usually offered: Fall 1954 and fall 1956

Course	Grade	Percent of enrollment, by geographic region[1]																	
		New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
		1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
General Science	9	.....	58.0	.....	90.6	.....	60.1	.....	75.7	.....	64.2	.....	65.5	.....	67.1	.....	54.1	.....	43.9
Biology	10	67.8	66.9	70.0	70.1	73.6	76.7	70.4	73.8	87.7	90.0	75.1	73.6	66.3	75.5	78.6	83.0	60.8	64.7
Chemistry	11	39.7	39.0	39.8	41.8	30.9	32.6	26.0	31.9	32.8	35.6	30.8	33.1	23.6	28.2	30.6	35.0	28.5	32.0
Physics	12	32.8	34.5	31.3	36.2	27.8	25.8	21.3	25.0	17.3	17.0	22.5	20.3	12.8	13.5	20.6	27.1	16.2	17.0

[1] For names of the States included in the region, see table 24, p. 42.

TABLE 6.—Number and percentage of schools, and their enrollments and percentages, where certain sciences were not offered: Fall 1956

Region	Course											
	No biology				No physics or chemistry				No science			
	Schools		Enrollment		Schools		Enrollment		Schools		Enrollment	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
All regions	175	9.9	6,012	3.3	323	18.2	6,023	4.8	274	15.4	4,821	3.8
New England	7	9.9	322	2.7	0	0.0	0	0.0	0	0.0	0	0.0
Middle Atlantic	9	5.1	1,418	4.4	5	2.8	265	1.3	4	2.2	128	0.6
East North Central	12	3.7	349	0.9	25	7.7	416	1.6	21	6.5	319	1.2
West North Central	56	15.8	904	5.0	99	28.0	1,404	9.7	82	23.2	1,092	7.5
South Atlantic	9	3.5	330	1.2	31	12.1	821	4.6	27	10.5	718	4.0
East South Central	17	10.9	738	6.0	39	25.1	961	11.3	27	17.4	641	7.5
West South Central	53	20.4	1,206	6.3	106	40.9	1,933	15.0	100	38.6	1,795	13.9
Mountain	11	12.6	286	4.4	11	12.6	125	2.5	9	10.3	103	2.1
Pacific	1	1.0	459	2.9	7	8.1	98	0.8	4	4.6	25	0.2

Table 6 is to be read as follows: In New England, 7 schools (9.9 percent of the sample with 10th grade) offered *no* biology. These schools had 322, or 2.7 percent of the 10th grade pupils in the sample. The other courses are to be interpreted similarly, except that the 12th grade is the base.

TABLE 7.—Enrollments in certain sciences and the ratio of these enrollments to enrollments in grades 9—12 and to enrollments in grade where subject is usually offered: Fall 1956

Subject	Sample			Estimates for United States		
	Enrollment	Ratio grades 9—12	Ratio subject grade	Enrollment	Ratio grades 9—12	Ratio subject grade
1	2	3	4	5	6	7
General science	144, 584	21.6	67.0	1, 518, 100	21.8	67.3
Biology	136, 159	20.3	75.5	1, 429, 700	20.5	74.0
Chemistry	50, 966	7.6	34.6	519, 000	7.5	34.4
Physics	30, 649	4.6	24.3	309, 600	4.4	24.5
Advanced general science	7, 716	1.2	6.1	77, 900	1.1	6.2
Other sciences	18, 277	2.7	14.5	188, 300	2.7	14.9

Table 7 shows the number and percent of pupils enrolled in certain sciences from the sample used for this study and from estimates for the Nation. These data are to be interpreted as follows: There were 144,584 pupils enrolled in general science in the schools of the sample. This number of pupils was equal to 21.6 percent of all pupils enrolled in grades 9—12 and also equal to 67.0 percent of all the pupils enrolled in the 9th grade in the schools of the sample. When these data are projected to the national level, it is estimated that 1,518,100 pupils are enrolled in 9th grade general science. This number of pupils is approximately 21.8 percent of all pupils enrolled in grades 9—12 and 67.3 percent of all the pupils enrolled in the 9th grade over the Nation. Similar interpretations are to be made for biology, chemistry, physics, advanced general science, and "other" sciences.

Ratio of Boys to Girls in Science Courses

A survey made by Philip G. Johnson [2] in 1947-48 found that 50 percent of the pupils taking chemistry and 71 percent taking physics were boys. Table 8 shows that for chemistry 56.9 percent in 1954 and 58 percent for 1956 were boys. Although the proportion of boys enrolled in physics increased from 71 percent in 1947 to 78 percent in 1954, it has remained fairly constant for the past 2 years since this study shows a 77.8 percent enrollment in 1956.

[2] Johnson, Philip G. The Teaching of Science in Public High Schools, Bulletin 1950, No. 9. Washington: U. S. Government Printing Office, 1950.

All science courses except biology enroll more boys than girls. In biology, the percentages are about the same, 49.5 percent boys and 50.5 percent girls. In many schools, biology is taken by practically all pupils because of local school requirements and limited offerings in other sciences.

TABLE 8.—Percent of pupils who are boys in certain science courses in public high schools, by type of school: Fall 1954 and fall 1956

Course	Grade level	Percent of boys									
		All high schools		Regular 4-year high school		Senior high school		Junior-senior high school		Undivided high school	
		1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12
General science	9		53.0		54.4		54.5		52.3		52.0
Biology	10	49.1	49.5	48.9	49.7	47.6	49.0	49.9	50.0	48.3	49.0
Chemistry	11	56.9	58.0	57.1	58.0	55.5	59.0	58.0	57.1	55.2	56.4
Physics	12	77.9	77.8	87.1	79.0	76.0	80.0	76.4	75.4	72.7	75.2
Other sciences	12	62.7	62.2	57.5	64.5	60.5	62.1	70.9	63.7	53.0	57.0

The proportion of boys to girls enrolled in 9th grade general science is very nearly the same for all types of high schools in this study. (See Table 8.) Over the past 2 years, the ratio of boys to girls enrolled in high school biology in all types of schools has remained about constant with a slight increase in the percentage enrollment of boys. The ratio of boys enrolled in chemistry increased slightly in senior high schools but remained fairly constant in other types. Although the overall pattern in physics showed the proportion of boys to girls remaining about constant from 1954 to 1956, there was a decrease in regular 4-year high schools from 87.1 percent boys in 1954 to 79 percent boys in 1956.

In the regular 4-year high schools, 79 percent of physics enrollments were boys, while in the senior high schools it was 80 percent. One might expect the percentage of girls taking physics to be less in senior high schools than in regular 4-year high schools, since the senior high schools usually have larger enrollments with a correspondingly greater number of elective courses.

It is possibly true that the selection of physics by girls is influenced more by other factors than those caused by variations in the type of school.

TABLE 9.—Percent of pupils who are boys in certain science courses in public high schools, by geographic region: Fall 1954 and fall 1956

Course	Percent, by geographic region[1]																			
	All regions		New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General science	.....	53.0	.....	58.0	.....	50.1	.....	52.3	.....	51.1	.....	55.5	.....	53.1	.....	53.2	.....	54.9	.....	57.5
Biology	49.1	49.5	48.9	49.4	49.8	50.0	48.1	50.0	47.8	49.2	47.7	49.0	50.0	49.2	50.7	49.0	51.5	50.8	49.7	50.6
Chemistry	57.0	58.0	56.6	58.7	56.1	55.3	58.5	59.6	59.6	58.1	53.3	54.8	51.6	57.8	61.7	61.8	61.1	61.4	57.9	60.6
Physics	80.0	77.8	86.2	83.8	78.6	77.3	76.1	77.1	80.0	76.0	71.2	72.9	66.7	74.7	78.0	77.9	80.5	84.7	80.8	83.0
Other sciences	62.7	62.2	67.7	69.6	71.9	71.6	61.3	59.5	52.2	54.8	58.6	47.1	55.3	55.1	53.6	65.6	50.6	70.6	56.6	53.3

[1] For names of the States included in the region, see table 24, p. 42.

TABLE 10.—Average class size, by geographic region, of certain science courses: Fall 1954 and fall 1956

Course	Average class size, by geographic region																	
	New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
General science		27.4		30.3		29.6		26.5		29.6		28.9		27.4		26.1		29.9
Biology	25.3	26.4	28.9	29.9	27.3	26.5	24.2	23.9	28.5	29.9	28.5	28.5	24.9	27.7	27.7	26.1	28.7	28.9
Chemistry	21.4	23.0	25.6	25.1	21.7	21.1	19.4	20.0	22.7	23.5	21.7	22.9	19.3	21.2	22.0	20.9	17.3	23.9
Physics	20.2	20.0	23.4	22.5	19.4	19.5	14.3	17.1	19.0	19.7	21.5	21.6	16.4	17.9	19.0	19.8	19.5	19.7
Other sciences	22.8	22.9	26.0	26.7	24.2	25.6	23.7	23.4	18.6	27.4	24.6	14.1	30.2	25.6	30.1	27.5	25.9	27.9

Table 10 shows by region a comparison for 1954 and 1956 of the average size of various science classes. These data reveal about the same conditions from region to region as prevail from one type of school to another (table 9): Average enrollments in general science are slightly larger than those for biology; on the average, the class size for biology is larger than for chemistry, and for chemistry larger than for physics. Although there were some changes in the average class size between 1954 and 1956 within given regions, the overall pattern was reasonably constant. The 1956 data show about the same pattern of variation of average class size for a given subject from region to region as did the 1954 data.

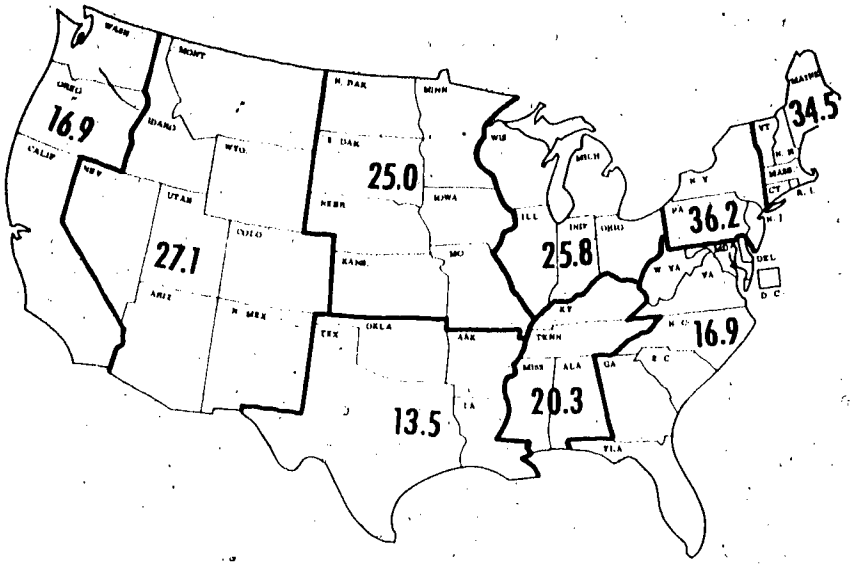
Size of Science Classes

Table 11 shows, by type of high school, a comparison for 1954 and 1956 of the average class size in certain science courses. Philip G. Johnson [3] reported that in 1947–48 the average class size in biology was 26; chemistry, 23; and physics, 19. The present study shows that for all high schools the average class size for 9th grade general science is 28.9. Over the past decade there seems to have been relatively little variation in the size of classes when all types of high schools are considered. For example, the average class size in biology, a course frequently required, increased only 0.5 percent rom 1947 to 1956. During the same period the average class size in chemistry decreased from 23 to 22.6 pupils, and in physics it increased slightly from 19 to 19.9. However, since these changes are so small, they may not be statistically significant. The 1947 study did not provide comparative data for the average class size in general science. (The average class size was computed by dividing the total enrollments in science by the total number of classes.) The present study did not provide data on the actual number of very large or very small science classes.

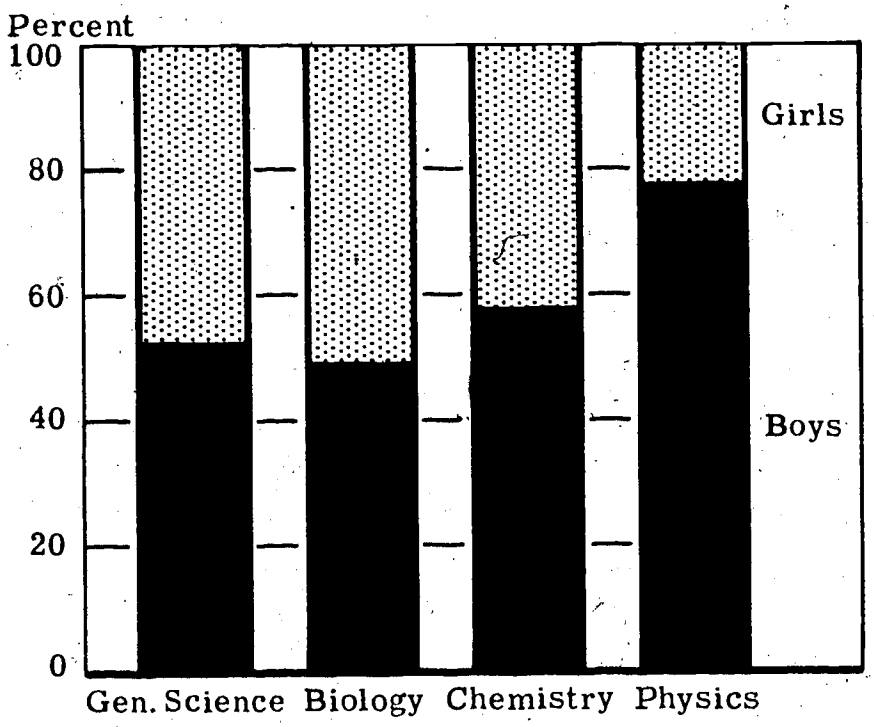
TABLE 11.—Average class size by type of school in certain science courses: Fall 1954 and Fall 1956

Course	Grade Level	Average class size, by type of school									
		All high schools		Regular 4-year high school		Senior high school		Junior-senior high school		Undivided high school	
		1954	1956	1954	1956	1954	1956	1954	1956	1954	1956
1	2	3	4	5	6	7	8	9	10	11	12
General science	9	.....	28.9	.....	27.5	.....	29.9	.....	29.6	.....	27.2
Biology	10	27.2	27.7	26.6	26.4	30.6	30.0	27.7	27.4	25.9	25.7
Chemistry	11	22.4	22.6	21.8	21.1	26.0	26.0	23.1	21.4	17.4	20.2
Physics	12	19.5	19.9	18.4	17.7	24.7	24.5	20.0	19.0	15.8	16.6
Other sciences	12	24.2	25.6	22.2	23.3	27.7	27.9	26.2	24.4	14.2	19.2

[3] Op. cit., p. 16.



Percent of 12th grade pupils in physics: Fall 1956



Boys and girls in science courses: Fall 1956

Schools Offering Mathematics

In this study, 91.9 percent of the schools with the 9th grade, had pupils enrolled in elementary algebra and 75.1 percent, in general mathematics. Table 12 shows that 1,462 schools in the sample offered plane geometry. This number was 81.2 percent of the schools enrolling pupils in the grade where the course is usually offered. Approximately two-thirds of the schools offered intermediate algebra, the course basic to further study in mathematics or science. About one-third had pupils enrolled in trigonometry, normally a 12th grade course. As the grade level of college preparatory mathematics courses increases, the number of schools offering the courses decreases. For example, table 12 shows 91.9 percent of the schools offering elementary algebra, a 9th grade course, and only 27.2 percent offering solid geometry, a 12th grade course.

Also the percentage of schools offering specific mathematics courses varies among types of schools. (See table 12.) The percentage offering elementary algebra was greater in the combined junior-senior high school than in any other type and least in the junior high school. Senior high schools had more extensive offerings in mathematics than any other type. This may be because there are fewer small schools in this type. The average senior high school 10th grade class in this study was 334; the same class in the regular 4-year high school was 70.

Since a fifth of our schools do not offer plane geometry, one might conclude that the same proportion of high school pupils do not have an opportunity to study this mathematics course, which is usually required of pupils going to college. Such a conclusion is false. The schools that did not offer plane geometry were small ones; the average 10th grade enrollment in these schools was 35 and represented 6½ percent rather than 20 percent of all 10th grade pupils in the study. (See table 13.)

Table 13 shows the percent of pupils, by type of school, that were in schools that did not offer certain mathematics courses. For example, 21,093 11th grade pupils were in schools that did not offer intermediate algebra; this number is 14.3 percent of all 11th grade pupils in the sample. There were 35,422 12th grade pupils, or 28.1 percent of all 12th grade pupils in the sample, who were in schools that offered neither solid geometry nor trigonometry. The category "other mathematics" is mostly non-college preparatory, such as business mathematics and advanced general mathematics, although occasionally including college-preparatory course. More than 10,000 pupils (8.0 percent) in the sample had no opportunity to study any type of advanced high school mathematics, whether college preparatory or non-college preparatory. A conservative estimate based on these data indicates that in the United States 100,000 of our high school seniors are in schools that do not offer advanced high school mathematics.

TABLE 12.—Number and percent of high schools, by type, offering certain mathematics courses: Fall 1956[1]

Course	Type of school											
	All high schools		Regular 4-year high school		Junior high school		Senior high school		Junior-senior high school		Undivided high school	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
General mathematics, 9th	1,468	75.1	565	68.2	240	90.6	.....	.....	332	79.2	213	69.4
Elementary algebra	1,796	91.9	756	91.3	224	84.5	.....	.....	400	95.5	284	92.5
Plane geometry	1,462	81.2	621	75.2	.....	.....	169	97.7	378	88.3	236	76.6
Intermediate algebra	1,125	63.3	450	55.2	.....	.....	154	89.0	298	70.0	181	59.0
Solid geometry	482	27.2	150	18.5	.....	.....	102	59.0	146	34.4	59	19.3
Plane trigonometry	591	33.4	196	24.1	.....	.....	101	58.4	196	46.1	75	24.5
Other mathematics	377	18.5	115	13.7	11	4.2	87	49.7	113	26.2	49	15.8

[1] Only those schools are included that have pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, it was not included in the data on plane geometry regardless of whether or not it offered geometry.

TABLE 13.—Number and percent [1] of pupils in high schools, by type of school, in the sample that did not offer certain mathematics courses: Fall 1956

Course	Grade	Number and Percent of Pupils											
		All high schools		Regular high school		Junior high school		Senior high school		Junior-senior high school		Undivided and ungraded high school	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14
General mathematics	9	28,226	13.1	1,606	17.2	4,085	7.4	.....	.....	5,772	13.0	2,905	15.6
Algebra I	9	7,263	3.4	1,790	2.7	2,585	4.7	.....	.....	1,755	3.9	965	5.2
Plane geometry	10	11,716	6.5	5,653	9.7	.....	.....	2,152	3.7	1,795	4.5	1,895	11.4
Intermediate algebra	11	21,093	14.3	9,621	19.8	.....	.....	2,566	5.4	4,896	14.8	3,364	24.3
Solid geometry or trigonometry	12	35,422	28.1	6,046	38.2	.....	.....	4,805	12.0	7,739	27.0	5,891	49.3
Intermediate algebra, solid geometry, trigonometry, or other mathematics	12	10,053	8.0	5,516	13.1	.....	.....	522	1.3	2,053	7.2	1,826	15.3
Other mathematics	12	71,101	56.4	29,233	69.6	.....	.....	13,103	32.8	17,061	59.6	9,085	76.0

[1] The percent is the ratio between the grade enrollment where the course, is usually offered, in those schools not offering the course, and the grade enrollment in the schools of the sample.

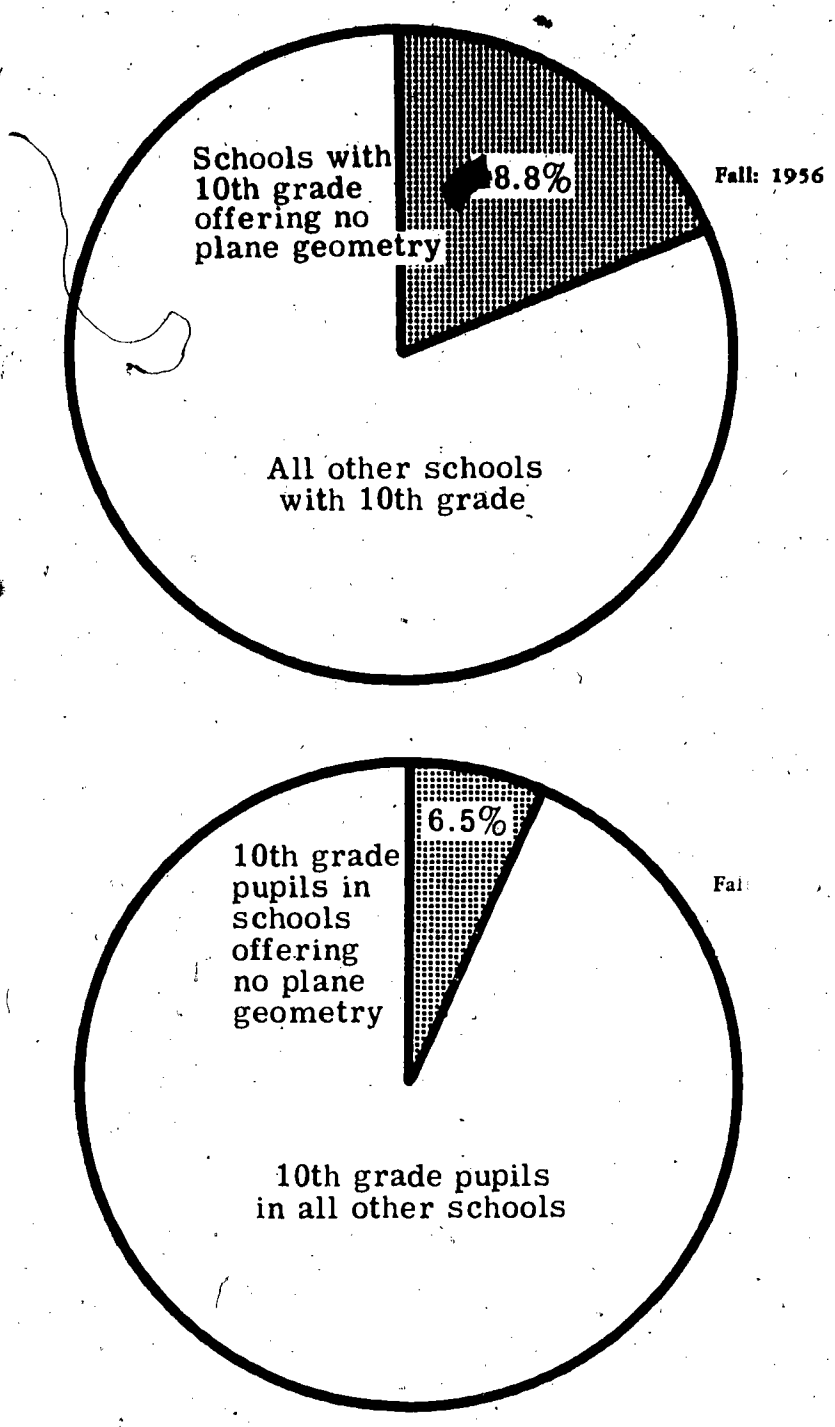

Schools with 10th grade offering no plane geometry
8.8%
All other schools with 10th grade
Fall: 1956
10th grade pupils in schools offering no plane geometry
6.5%
10th grade pupils in all other schools
Fall

TABLE 14.—Number and percent of schools, by geographic region, offering certain mathematics courses: Fall 1956 [1]

Course	Geographic region [2]																			
	All Regions		New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
General mathematics	1,468	75.1	66	83.5	146	69.2	270	78.3	240	64.2	237	85.6	163	88.6	182	64.1	68	71.6	96	90.6
Elementary algebra	1,796	91.9	75	94.9	208	98.5	339	98.2	325	86.9	247	89.2	153	83.2	262	92.3	88	92.6	55	94.3
Plane geometry	1,462	81.2	73	86.3	181	93.9	328	89.0	358	70.4	363	58.7	156	78.2	209	78.9	74	84.1	77	86.5
Intermediate algebra	1,125	63.3	62	86.1	166	92.7	224	69.1	155	43.7	172	66.4	101	64.7	135	51.7	49	60.0	61	70.9
Solid geometry	482	27.2	34	47.9	93	52.2	124	38.4	56	15.8	61	23.7	30	19.4	35	13.5	23	26.7	26	30.2
Trigonometry	591	33.4	51	71.8	132	74.2	140	43.3	57	16.1	63	24.5	26	16.8	43	16.6	37	43.0	42	48.9
Other mathematics	377	18.5	35	40.2	82	37.3	57	15.8	29	9.2	72	24.8	22	12.3	44	15.1	8	8.2	27	22.9

[1] Only those schools are included that had pupils in the grade where the course is usually offered. For example, if a school did not have pupils in the 10th grade, it was not included in the data on plane geometry.

[2] For names of the States included in the region, see page 42.

Table 14 shows the variation, by geographic region, in the percentage of schools offering mathematics courses. The percentage of schools offering plane geometry varied greatly among the geographic regions. In the South Atlantic region only 58.7 percent of the schools included plane geometry in their offerings, while in the Middle Atlantic region the percentage was 93.9. In the West South Central region only 16.6 percent of the schools offered trigonometry and in the Middle Atlantic region, 74.2. Likewise, the percent offering "other" mathematics was 5 times greater in one region than in another.

Table 15 shows the variation, by geographic region, in the number and percent of pupils in schools that did *not* offer certain mathematics courses. In the Pacific region the schools that did not offer plane geometry enrolled only 1.9 percent of the 10th grade pupils in that region, while in the West South Central region the figure was 11.9 percent. The schools in the West North Central region that did not offer intermediate algebra had 4,494 pupils in the 11th grade, the grade where the subject is usually offered. The great variation among high schools offering college preparatory mathematics is indicated by the number and percent of schools that offered neither intermediate algebra, trigonometry, solid geometry, nor "other" mathematics. In the Middle Atlantic region only 83 schools, representing 0.4 percent of the 12th grade pupils in that region, failed to offer these subjects, while in the West North Central region there were 2,769 schools, representing 19.1 percent of their 12th grade pupils.

During a national shortage of specialized personnel is it not unfortunate that so many schools in certain sections of our Nation fail to provide an opportunity for youth to develop their full potential in mathematics?

Enrollments in Mathematics Courses

Table 16 shows the percentage of pupils in the last 4 years of public high schools enrolled in algebra, geometry, and trigonometry from 1889–90 through 1956–57. The percentage of pupils enrolled in algebra declined steadily from 1900 to 1954. During 1954–56, however, the percentage increased from 24.8 to 28.7. Geometry is usually recommended for college preparatory pupils, especially those who plan on scientific careers. For many years the percentage of pupils enrolled in this subject declined and from 1934 to 1954 the actual enrollments decreased. This study indicates, though, that the trend has changed.

TABLE 15.—Number and percent of pupils in high schools, by geographic region, in the sample that did not offer certain mathematics courses: Fall 1956 [1]

Course	Grade	Geographic region [2]																			
		All regions		New England		Middle Atlantic		East North Central		West North Central		South Atlantic		East South Central		West South Central		Mountain		Pacific	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
General mathematics	9	28,226	13.1	1,868	12.6	6,652	16.8	4,173	9.8	4,493	20.9	2,352	7.6	1,160	7.8	4,503	21.2	939	11.4	2,086	9.5
Algebra I	9	7,263	3.4	357	2.4	510	1.3	735	1.7	886	4.1	2,608	8.4	958	6.5	438	2.1	519	6.3	252	1.2
Plane geometry	10	11,716	6.5	1,009	8.4	896	2.8	994	2.7	2,086	11.6	2,680	10.0	1,277	10.4	2,284	11.9	190	2.9	300	1.9
Intermediate algebra	11	21,093	14.3	756	8.0	982	3.8	3,490	11.3	4,494	27.9	3,824	18.2	2,125	21.0	3,353	22.0	963	17.0	1,106	8.6
Solid geometry or trigonometry	12	35,422	28.1	1,118	13.9	2,457	11.7	5,514	20.8	7,036	48.5	7,281	40.6	4,414	51.9	5,255	40.8	1,176	23.7	1,171	10.0
Trigonometry, intermediate algebra, solid geometry, or other mathematics	12	10,053	8.0	375	4.7	83	0.4	1,543	5.8	2,769	19.1	1,691	9.2	1,220	14.3	1,724	13.4	332	6.7	356	3.1
Other mathematics	12	71,101	56.4	2,646	49.2	5,942	39.6	16,417	61.8	11,134	76.8	9,097	50.7	7,371	86.6	9,349	72.6	3,349	67.5	5,796	49.7

[1] The percent is the ratio of the enrollment, in the grade where the subject is usually offered, of the schools that do not offer the subject to the enrollment in the same grade of the schools in the sample. The number is the number of pupils on that grade level in the region.

[2] For names of the States included in the region, see page 42.

TABLE 16.—Percentage of pupils in the last 4 years of public high schools in certain mathematics courses 1889–90 through 1956–57

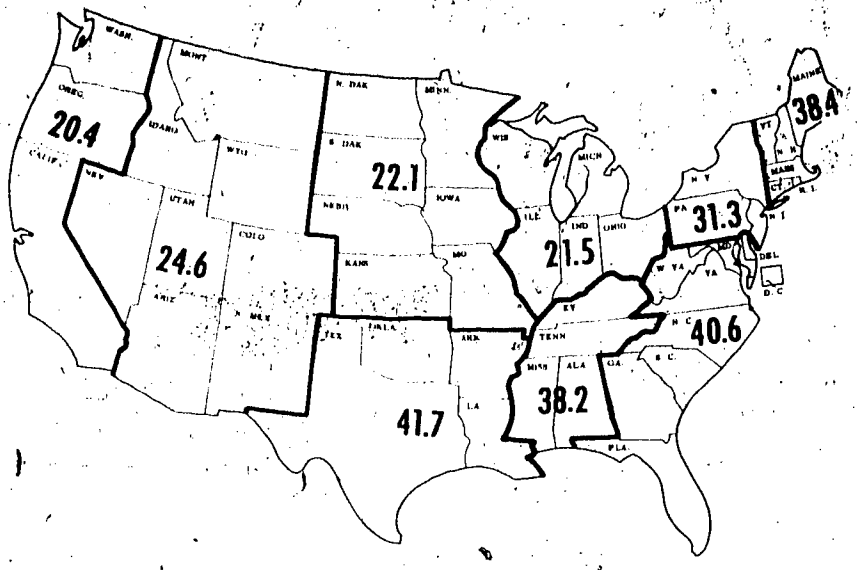
Year	Percent of pupils			Year	Percent of pupils		
	Algebra	Geometry	Trigonometry		Algebra	Geometry	Trigonometry
1	2	3	4	1	2	3	4
1890 [1]	45.4	21.3	1.9	1934	30.4	17.1	1.3
1900	56.3	27.4	1.9	1949	26.8	12.8	2.0
1910	56.9	30.9	1.9	1952–1953 [2]	24.6	11.6	1.7
1915	48.8	26.5	1.5	1954–1955 [3]	24.8	11.4	2.6
1922	40.2	22.7	1.5	1956–1957 [4]	28.7	13.6	2.9
1928	35.2	19.8	1.3				

[1] Biennial Survey of Education in the United States, 1948–50, chapter 5, p. 107. Washington: U. S. Government Printing Office, 1951.
[2] Brown, Kenneth E. Mathematics in Public High Schools, Bulletin 1953, No. 5, p. 34. Washington: U. S. Government Printing Office, 1953.
[3] ——— Offerings and Enrollments in Science and Mathematics in Public High Schools, Pamphlet No. 118, p. 16. Washington: U. S. Government Printing Office, 1956.
[4] Estimate based on this study.

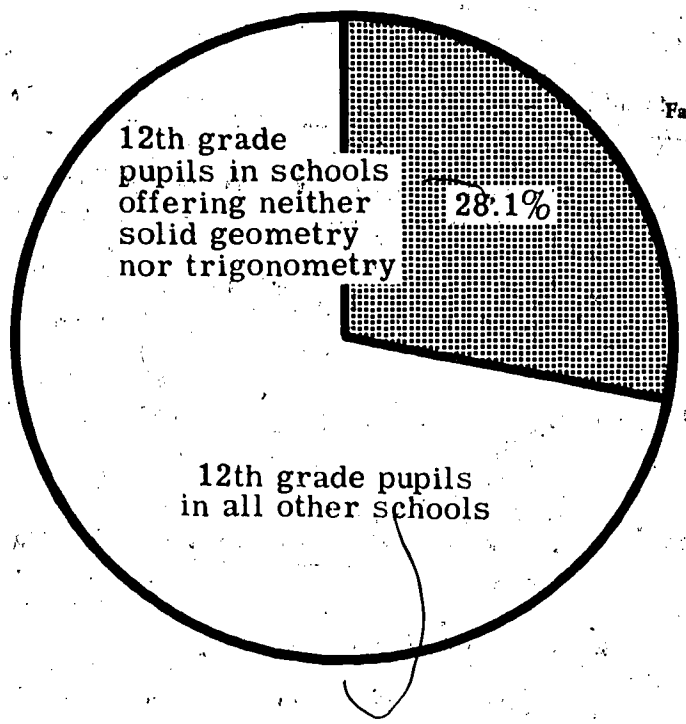
In interpreting Table 16, at least two facts should be recalled. First, the percentage given is the ratio of pupils taking the subject to all the pupils in the last 4 years of high school. For example, the percentage for trigonometry in 1956 is 2.9, which means that 2.9 percent of all those enrolled in the last 4 years of high school were enrolled in trigonometry in the fall of 1956. Normally, enrollment in the 12th grade (where trigonometry is usually offered) would not constitute more than 20 to 25 percent of the total enrollment in the last 4 years of high school. Thus, the maximum enrollment in trigonometry would not likely exceed that percentage. Second, the number of high school pupils has increased in recent years. The percentage of pupils in a subject may have remained constant or even decreased, while the number actually increased. The percentage of pupils enrolled in trigonometry has remained rather constant but the number has increased 20-fold since 1900.

Enrollments Expressed as the Percentage of the Pupils

A different, perhaps more accurate, picture of mathematics enrollments is given by using, as a base, the enrollment in the grade where the course is normally offered rather than the total enrollment in the last 4 years of high school.



Percent of 11th grade pupils in intermediate algebra: Fall 1956

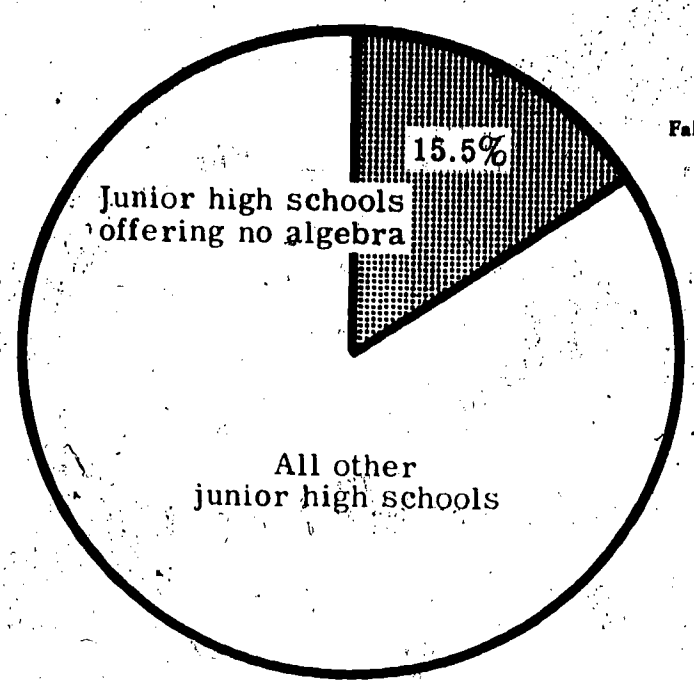


Fall: 1956

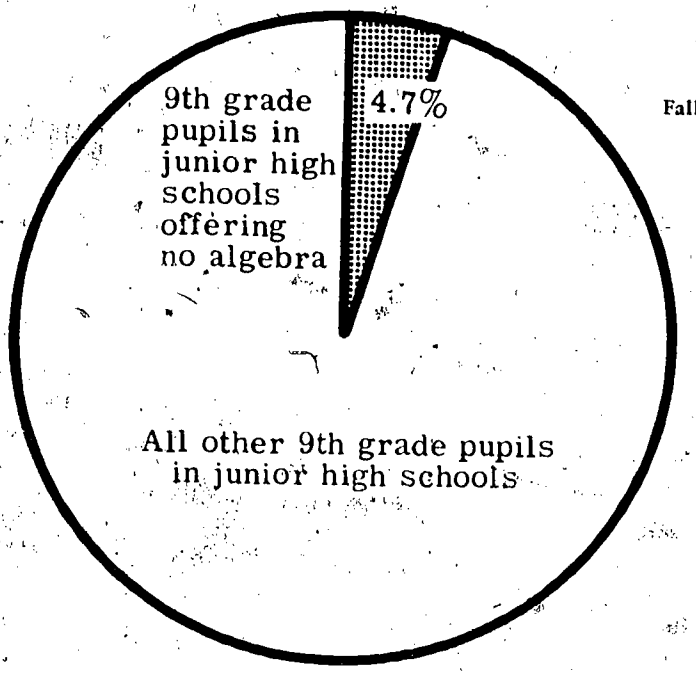
TABLE 17.—Comparison of enrollments, by type of school, in certain mathematics courses expressed as the percent of pupils in grade where course is usually offered: Fall 1954 and fall 1956

Year, by course	Grade	Percent of pupils					
		All high schools	Regular 4-year high school	Junior high school	Senior high school	Junior-senior high school	Undivided high school
1	2	3	4	5	6	7	8
General mathematics	9						
1954		44.5	46.2	42.0		41.3	52.3
1956		43.1	44.6	41.1		41.9	50.1
Elementary algebra	9						
1954		64.5	65.9	43.8		66.4	69.1
1956		67.0	69.5	51.7		69.2	68.0
Plane geometry	10						
1954		37.4	38.4		33.6	40.0	34.1
1956		41.6	40.3		43.8	41.7	37.8
Intermediate algebra	11						
1954		28.5	27.6		23.8	29.6	36.4
1956		32.2	29.6		34.5	31.4	35.3
Plane trigonometry	12						
1954		7.4	6.7		7.7	8.9	4.7
1956		9.2	7.9		9.4	10.9	8.2
Solid geometry	12						
1954		6.5	6.5		6.0	7.5	4.4
1956		7.6	7.1		7.6	8.4	6.8

Table 17 shows enrollments in mathematics expressed as the percentage of pupils in the grade level where the course is usually offered. It may be read as follows: The number of pupils enrolled in elementary algebra in all schools in 1954 was 64.5 percent of the number of pupils in the 9th grade; in 1956, 67.0 percent. The junior high school has had a greater increase in algebra pupils than any other type of school. Although enrollments in both elementary algebra, a college preparatory course, and general mathematics, a noncollege preparatory course, increased, the former increased more. In the junior high school the combined enrollment in general mathematics and algebra was equal to 85.8 percent of the pupils in the 9th grade in 1954 and 92.8 percent in 1956. The combined enrollments in general mathematics and elementary algebra, however, in some schools exceeded 100 percent of the 9th grade pupils. This is because some 10th grade pupils took elementary algebra.



Fall: 1956



Fall: 1956

In plane geometry the enrollments were approximately 37 percent of the 10th grade pupils in 1954 and 42 percent in 1956. The percentage for intermediate algebra increased also: enrollments rose to nearly one-third of the number of 11th grade pupils. Advanced mathematics, solid geometry, and trigonometry also increased in enrollments. The enrollments for solid geometry and trigonometry in the fall of 1956 were 7.6 and 9.2, respectively, of the number of pupils in the 12th grade.

After adjustments for the usual drop-outs in half-year subjects, it is estimated that the number of pupils enrolled in solid geometry and trigonometry during the school year 1956-57 was 160,000 and 200,000 respectively. This was approximately 12.6 percent and 15.8 percent of all 12th grade pupils in the public high schools. This study indicates that two-thirds of the high school youth in the United States take elementary algebra; one-third, intermediate algebra; two-fifths, plane geometry; and about one-eighth, solid geometry and trigonometry.

Mathematics Enrollments in Various Geographic Regions

Enrollments in mathematics vary according to the geographic location of the schools. In the South Atlantic region the enrollment in 9th grade general mathematics is equal to 58.7 percent of all 9th-grade pupils, while in the Middle Atlantic region the percentage is 30.7. (See table 18.) The percentage of pupils enrolled in elementary algebra is higher in the West South Central than in the Pacific region. In the case of plane geometry, the percent varies from 28.1 in the South Atlantic region to 52.1 percent in the Mountain region. The lowest percent in trigonometry is 5.3 in the East South Central region; the highest, 15.1 in the Middle Atlantic region. This variation in enrollment may raise the question: Is it possible that the proportion of youth who can profitably study trigonometry is three times greater in the Middle Atlantic region than in the East South Central?

Comparison of Enrollments, by Geographic Region, 1954-56

During 1954-56, in most regions, there were increases in the percentage of pupils studying college preparatory mathematics. There are few exceptions, such as the Pacific region, where there was a decrease from 69.9 to 57.2 in the percentage of pupils taking elementary algebra. In only one course, trigonometry, was there an increase in all geographic regions. General mathematics, a noncollege preparatory course, showed a slight decrease in percentage of pupils enrolled.

The regions have changed very little in relation to each other between 1954 and 1956; i. e., the regions with a large percentage of pupils enrolled in certain mathematics courses in 1954 had large percentages in 1956 and those that were low in 1954 were low in 1956.

TABLE 18.—Comparison of enrollments, by geographic region, in certain mathematics courses expressed as the percent of pupils in grade where course is usually offered: Fall 1954 and fall 1956

Year, by course	Percent of enrollment, by geographic region									
	All regions	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade)										
1954	44.5	30.8	32.1	50.8	44.2	61.0	55.2	46.7	49.0	45.8
1956	43.1	33.7	30.2	40.6	42.4	58.7	57.8	44.8	44.6	42.8
Elementary algebra										
1954	64.5	60.8	60.3	60.7	66.4	64.2	72.5	72.2	81.8	69.9
1956	67.0	59.8	63.7	65.6	72.8	61.9	74.8	83.2	76.9	57.2
Plane geometry										
1954	37.4	44.1	44.8	37.2	36.3	26.4	33.6	45.7	37.5	32.3
1956	41.6	45.3	47.2	42	43.9	28.1	36.8	43.3	52.1	41.5
Intermediate algebra										
1954	28.5	34.0	37.3	16.8	16.2	37.9	36.5	45.1	15.2	12.8
1956	32.2	38.4	42.0	21.5	22.1	40.6	38.2	41.7	24.6	20.4
Solid geometry										
1954	6.5	12.9	8.7	6.8	4.8	4.8	4.7	5.5	5.0	5.0
1956	7.6	10.3	10.4	8.3	7.1	5.9	6.9	5.2	8.8	4.5
Plane trigonometry										
1954	7.4	13.1	12.7	6.3	5.3	5.6	4.4	4.4	6.7	6.0
1956	9.2	13.4	15.1	9.2	6.4	6.3	5.3	6.0	12.8	8.3

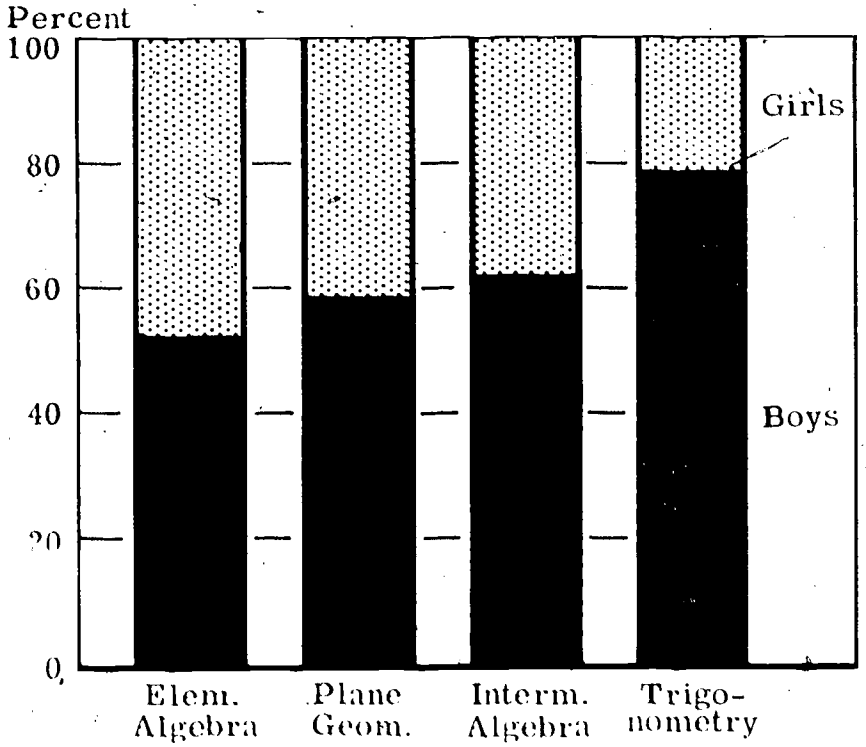
For example, the three regions having the largest percentages of pupils enrolled in elementary algebra in 1954 were the three regions with the largest percentages in 1956. This was true also in intermediate algebra and trigonometry. The three regions with the lowest percentages of pupils in plane geometry in 1954 were also the three lowest in 1956. The two regions with the highest percentages of pupils enrolled in general mathematics, and the two regions with the largest percentages in solid geometry in 1954 were again in 1956 the regions with the highest percentages in these subjects. Thus, the regions with large or small percentages in 1954 were in general those with large or small percentages in 1956.

The same variations between regions existed in both 1954 and 1956. The percentage of pupils enrolled in a particular mathematics course in one region was two or three times the percentage in another region. (See Trigonometry in table 18.)

From the data in table 17 it is valid to conclude that the percentage of pupils in the United States taking noncollege preparatory mathematics has remained constant during the past 2 years, that in college preparatory mathematics there has been a small increase, and that the regions with high percentages of mathematics enrollments in 1954 were high in 1956.

Ratio of Boys to Girls in Mathematics Courses

The number of boys exceeds the number of girls only slightly in required mathematical courses. In the 9th grade algebra course 52.6 percent of the pupils are boys. As the courses become electives the percentage of boys increases. (See chart below.) In solid geometry, usually an elective



Enrollment ratios, boys and girls in mathematics courses: Fall 1956

12th grade course, the ratio of boys to girls is nearly 4 to 1. Since this subject is usually taken by pupils who expect to study college mathematics or science, one might expect that the class ratio of boys to girls would become higher

TABLE 19.—Percent of pupils who are boys in certain mathematics courses in public high schools, by type of school: Fall 1954 and fall 1956

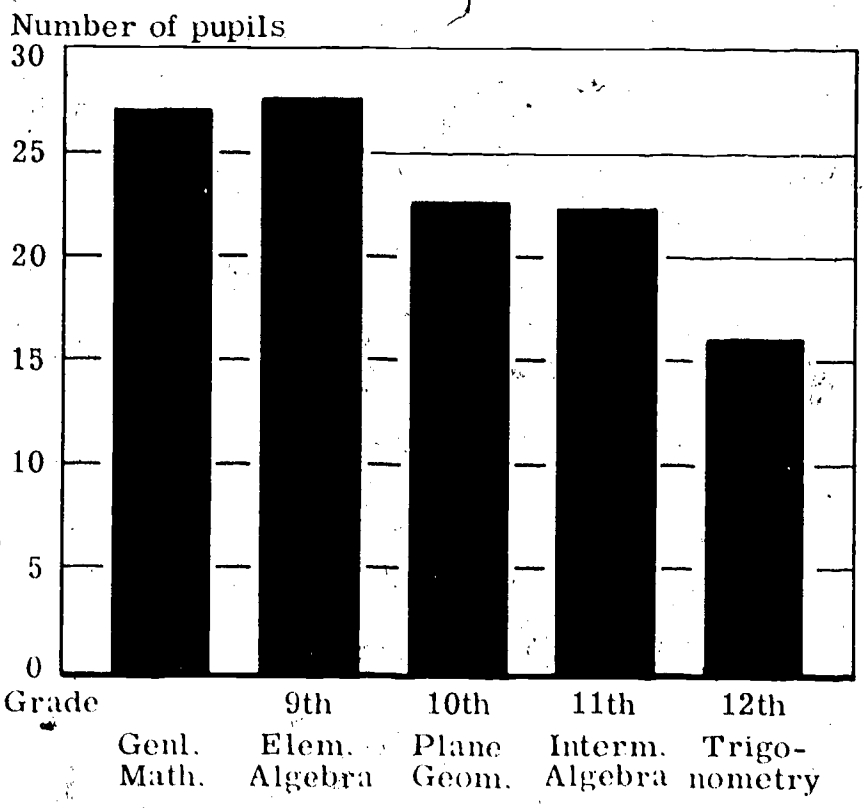
Year, by course	Percent of pupils					
	All high schools	Regular 4-year high school	Junior high school	Senior high school	Junior-senior high school	Undivided high school
1	2	3	4	5	6	7
General mathematics (9th grade)						
1954	52.9	53.9	51.3	55.4	53.3	51.1
1956	52.8	54.7	51.1	53.8	52.3	50.8
Elementary algebra:						
1954	52.5	53.0	50.2	61.8	52.4	50.0
1956	52.6	53.1	50.5	54.2	52.4	52.5
Plane geometry:						
1954	59.0	59.7		59.8	58.1	58.4
1956	58.9	58.1		59.7	58.6	59.1
Intermediate algebra:						
1954	60.9	60.8		63.9	60.9	57.7
1956	62.3	61.8		62.5	63.5	60.5
Plane trigonometry:						
1954	78.5	81.4		80.9	75.7	74.8
1956	78.9	79.2		79.8	77.7	79.1
Solid geometry:						
1954	78.8	81.3		80.3	75.9	78.3
1956	79.3	79.7		79.4	77.5	82.5
Other high school mathematics:						
1954	61.7	61.2		63.3	64.9	48.5
1956	61.3	62.1		63.1	58.0	57.2

Table 19 shows the percentage of pupils who are boys in the various mathematics courses by type of school for 1954 and 1956. The ratio of boys to girls varies little from one type of school organization to another or from the 1954 survey to the 1956. Since there has been considerable publicity given to the shortage of scientists and engineers, one might expect that the increased enrollments in high school elective mathematics courses were mostly boys; however, this does not seem to have been the case. The increase in mathematics enrollments has not altered the ratio.

Size of Mathematics Classes

The largest classes reported for this study were algebra classes in the junior high school. The average junior high school algebra class had more than 30 pupils. For all schools the average was 27.6. General mathematics classes were only slightly smaller, with an average enrollment of 27.0.

The undivided high school had the smallest average class size, 12.1, and the subject was trigonometry. The 4-year high school, which enrolls more pupils than any other type of high school, had an average class size in trigonometry of 15 pupils. The class size in this type of school was approximately 26 in algebra and general mathematics. Most mathematics courses had an increase in average class size, from 1954 to 1956. (See table 20.)



Average class size of certain mathematics courses: Fall 1956

TABLE 20.—Comparison of average size, by type of school, of certain mathematics classes: Fall 1954 and fall 1956

Year, by course	Average class size					
	All high schools	Regular 4-year high school	Junior high school	Junior-senior high school	Senior high school	Undivided high school
1	2	3	4	5	6	7
General mathematics (9th grade):						
1954	26.6	25.9	26.7	27.1	.....	25.8
1956	27.0	25.7	28.9	27.4	.....	24.9
Elementary algebra:						
1954	27.4	26.4	29.7	28.8	.....	24.8
1956	27.6	25.6	30.8	28.7	.....	24.4
Plane geometry:						
1954	23.0	21.1	.....	24.6	28.6	18.3
1956	22.6	20.6	.....	23.3	28.9	13.7
Intermediate algebra:						
1954	22.0	20.1	.....	22.8	28.0	19.9
1956	22.4	20.4	.....	20.3	27.9	19.3
Plane trigonometry:						
1954	15.9	14.2	.....	16.2	22.5	10.6
1956	16.1	14.9	.....	13.7	23.6	12.1
Solid geometry:						
1954	16.1	15.9	.....	15.6	22.2	11.2
1956	16.4	16.4	.....	14.1	21.8	12.2
Other high school mathematics:						
1954	26.4	24.9	.....	26.8	27.3	24.2
1956	24.0	19.9	.....	24.1	27.3	17.6

The average class size, however, does not really reflect the classroom situation. There is no *average* class—all classes are either larger or smaller than the average. In 1952 a survey [1] showed that 60 percent of the mathematics classes of the junior high school contained more than 30 pupils. The number of very large or very small classes was not secured in the survey of 1956; however, table 21 shows the variation in class size by geographic region. In the South Atlantic region in 1956 the average class size was more than 30 pupils in general mathematics, while in the West North Central region the average in the same subject was 22.5. A similar difference

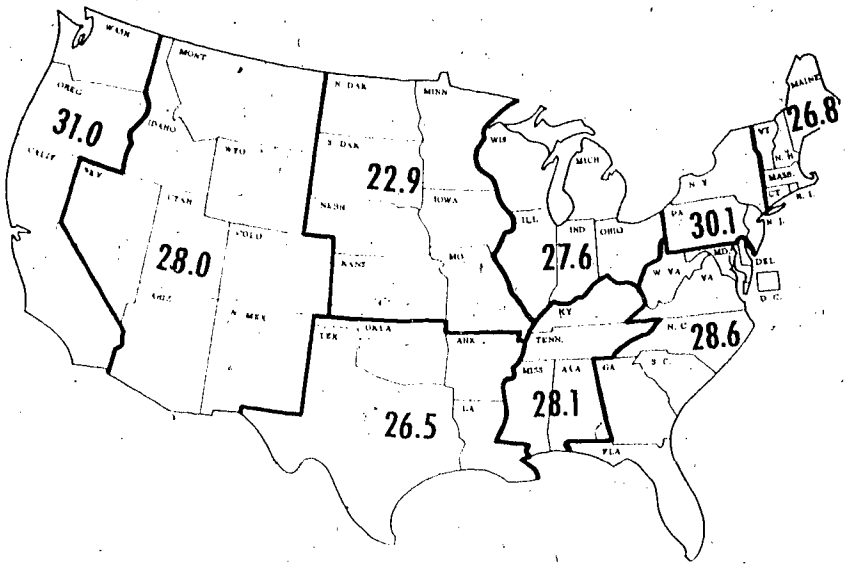
[1] Brown, Kenneth E. Mathematics in Public High Schools. Bulletin 1953, No. 5, p. 37. Washington: U. S. Government Printing Office, 1953.

in average class size in algebra existed between the Middle Atlantic region and the West North Central region.

Table 21 shows the average class size in the regions with the largest classes increased from 1954 to 1956. Two regions had an average class size in algebra exceeding 30 pupils. An average of 30 indicates many large classes where provision for individual differences would be very difficult, if not impossible. These large classes are usually in the 9th grade. At the very time when pupils need individual classroom assistance to understand basic mathematics, they unfortunately find themselves in the largest classes.

TABLE 21.—Comparison of average class size, by geographic region, of certain mathematics classes: Fall 1954 and fall 1956

Year, by course	Average class size, by geographic region									
	All regions	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
1	2	3	4	5	6	7	8	9	10	11
General mathematics (9th grade):										
1954	26.6	24.4	28.5	26.4	21.1	30.5	27.2	24.6	26.1	28.8
1956	27.0	25.0	28.5	26.0	22.5	30.1	28.2	26.1	26.3	28.1
Elementary algebra:										
1954	27.4	25.9	29.0	27.4	25.4	27.9	27.5	26.5	25.7	29.8
1956	27.6	26.8	30.1	27.6	22.9	28.6	28.1	26.5	28.0	31.0
Plane geometry:										
1954	23.0	23.5	27.1	22.9	18.8	20.7	21.8	21.9	22.7	27.3
1956	22.6	25.2	27.2	22.4	17.2	22.3	22.3	22.4	23.5	28.2
Intermediate algebra:										
1954	22.0	22.1	25.0	19.6	14.6	22.9	22.6	23.2	19.4	21.3
1956	22.4	24.5	25.5	18.0	17.7	24.6	22.1	23.5	20.0	23.8
Plane trigonometry:										
1954	15.9	14.8	18.6	14.6	13.0	17.3	13.5	12.8	16.4	16.3
1956	16.1	16.6	18.2	14.2	15.1	15.5	16.0	16.3	15.2	17.4
Solid geometry:										
1954	16.1	17.2	17.7	16.0	13.5	14.3	13.6	16.3	14.9	19.9
1956	16.4	18.0	18.2	14.8	16.3	14.9	16.9	17.2	16.8	16.8
Other high school mathematics:										
1954	26.4	24.1	26.8	23.8	24.8	29.0	28.9	24.7	28.0	27.4
1956	24.0	25.8	25.7	24.4	18.6	22.6	15.7	22.7	29.6	26.9



Average class size, elementary algebra: Fall 1956

Characteristics of the Sample

The sample used in this study was composed of 2,375 public high schools selected at random from the 23,746 public high schools listed in the Office of Education *Directory of Secondary Day Schools, 1951–52*.[5] The schools used in this sample were the same schools used in the 1954 survey.[6]

The authors wish to acknowledge the prompt cooperation of the high school principals in returning 90 percent of the questionnaires that made this study possible. Some of the questionnaires were not included in the survey because the data provided were not usable. For example, a few schools reported that they were no longer high schools or that they no longer existed. However, of the total response 2,038 provided complete and pertinent information.

The percentage of the various types of schools that returned usable questionnaires was approximately the same as for the respective types in the United States. (See table 22.) The regular (4-year) high schools were 41.1 percent of the public high schools in the sample and 42.8 of all public high schools in the United States, 1951–52. Perhaps this difference

[5] Rice, Mabel C. Directory of Secondary Day Schools, 1951–52. Washington: U. S. Government Printing Office, 1952.

[6] Brown, Kenneth E. Offerings and Enrollments in Science and Mathematics in Public High Schools. Pamphlet No. 118. Washington: U. S. Government Printing Office, 1956.

does not distort the true picture, nationally, because of two factors. First, the large number (838) of this category in the sample would include most variations. Second, the number of regular 4-year public high schools has been decreasing. The figures in the sample are closer to the 1956 than to the 1951–52 figures for the United States. It was the latter figures with which the 1954 and the 1956 studies were compared.

TABLE 22.—Comparison, by type, of number of public high schools in the study with the total number in the United States

Type of school	Number and percent of schools			
	The United States (1951–52)		This study	
	Number	Percent	Number	Percent
1	2	3	4	5
Junior high school	3,227	13.6	265	13.0
Senior high school	1,760	7.4	173	8.5
Regular (4-year) high school	10,168	42.8	838	41.1
Junior-senior high school	8,591	36.1	741	36.4

TABLE 23.—Percent of pupils in each of the last 4 years of public high schools compared with the pupils used in this study

Item	Percent of pupils			
	First year	Second year	[illegible]	Fourth year
1	2	3	4	5
United States (1956)	32.3	27.7	21.7	18.3
This study	32.2	26.9	22.0	18.8

TABLE 24.—Comparison, by geographic region, of the number of public high schools in the study with the total number in the United States

Geographic region	Number and percent of schools			
	The United States (1953–54)		This study	
	Number	Percent	Number	Percent
1	2	3	4	5
1. NEW ENGLAND (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)	1, 102	4. 3	87	4. 3
2. MIDDLE ATLANTIC (New York, New Jersey, Pennsylvania)	2, 836	11. 0	220	10. 8
3. EAST NORTH CENTRAL (Ohio, Indiana, Illinois, Michigan, Wisconsin)	3, 814	14. 9	362	17. 8
4. WEST NORTH CENTRAL (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)	3, 955	15. 4	378	18. 6
5. SOUTH ATLANTIC (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)	4, [illegible]	16. 5	293	14. 4
6. EAST SOUTH CENTRAL (Kentucky, Tennessee, Alabama, Mississippi)	3, 174	12. 4	187	9. 1
7. WEST SOUTH CENTRAL (Arkansas, Louisiana, Oklahoma, Texas)	3, 953	15. 4	293	14. 4
8. MOUNTAIN (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)	1, 360	5. 3	99	4. 9
9. PACIFIC (Washington, Oregon, California)	1, 222	4. 8	119	5. 8
Total	25, 637	100. 0	2, 038	100. 0

The grade distribution of schools whose returns were used in this study are representative of the schools in the United States. (See table 23.) The percentage difference between the pupils in any grade in the study and in the United States is less than one.

Table 24 compares, by geographic region, the number of public high schools in the study with the total number in the United States. Although the returns used in the study are representative of the regions in the United States, the number of schools from a particular State is too small for valid generalizations on a State basis.

National Generalizations

Although the questionnaire was sent to 10 percent of the public high schools in the United States listed in the *Directory of Secondary Day Schools, 1951–52*, one cannot secure valid data on a national level by multiplying *all* the sample data by 10 or any other factor.

Many factors must be considered in extrapolating the sample data for national generalizations. For example, the usable returns were from 90 percent of the 10-percent sample. A few schools did not return the forms, some schools have consolidated or closed since 1952, and new schools have opened. The large enrollment bulge has worked its way into the junior high schools. Already filled to capacity, they have been forced to transfer all or some of the 9th grade to senior high schools. Thus, some of the types of schools have changed since 1952. The sample contained approximately 175 senior high schools, which constituted 10 percent of the senior high schools listed in 1952. Of these 175 schools, two-thirds were no longer senior high schools in 1956.

Other factors must be considered. A course may be a half-year course with a larger enrollment one semester than the other. Another course may be a full-year or a half-year one. Courses may be offered every other year. Also, when interpreting the sample, the reader should bear in mind the differences between the sample and the universe. Taking this into consideration, the authors have given throughout this pamphlet estimates of certain data on a national level. For information on the actual sample values, see pages 16, 24, and 26.

TABLE 25.—Enrollment and population changes by years

Item	Typical grade	Typical age group	Years			Percent of Increase
			1948–49 [1]	1954–55 [2]	1956–57 [3]	1948–49 to 1956–57
1	2	3	4	5	6	7
Subject						
General Science	9		1, 074, 000	(4)	1, 518, 000	41. 3
Biology	10	15	996, 000	1, 294, 000	1, 430, 000	43. 6
Chemistry	11	16	412, 000	843, 000	520, 000	26. 2
Physics	12	17	291, 000	303, 000	310, 000	6. 5
Other Science	9-12		155, 000	(4)	265, 000	71. 0
Total Science	9-12		2, 928, 000	(4)	4, 043, 000	38. 1
Elementary algebra	9	14	1, 042, 000	1, 205, 000	1, 518, 000	45. 7
Intermediate algebra	11	16	407, 000	432, 000	484, 000	30. 1
General mathematics	9	14	705, 000	800, 000	976, 000	50. 2
Plane geometry	10	15	599, 000	664, 000	788, 000	31. 6
Solid geometry	12	17	94, 000	147, 000	160, 000	70. 2
Trigonometry	12	17	109, 000	170, 000	200, 000	83. 5
Other Mathematics	9-12		91, 000	(4)	275, 000	282. 2
Total Mathematics	9-12		2, 957, 000	(4)	4, 401, 000	48. 8
Grade						
9			1, 641, 000	1, 997, 000	2, 254, 000	37. 4
10			1, 491, 000	1, 782, 000	1, 933, 000	29. 6
11			1, 242, 000	1, 500, 000	1, 513, 000	23. 1
12			1, 026, 000	1, 304, 000	1, 263, 000	23. 1
9-12			5, 399, 000	6, 583, 000	6, 963, 000	29. 0
Population age group						
14			2, 126, 000	2, 288, 000	2, 556, 000	20. 2
15			2, 140, 000	2, 296, 000	2, 393, 000	11. 8
16			2, 231, 000	2, 258, 000	2, 292, 000	2. 7
17			2, 206, 000	2, 169, 000	2, 300, 000	4. 3
14-17			8, 703, 000	9, 011, 000	9, 541, 000	9. 6

[1] Biennial Survey of Education in the United States—1948-50, chapter 5, Offerings and Enrollments in High School Subjects, 1948-49, table 7, p. 107. Washington: U. S. Government Printing Office, 1951.

[2] Brown, Kenneth E. Offerings and Enrollments in Science and Mathematics in Public High Schools, Pamphlet No. 118. Washington: U. S. Government Printing Office, 1956.

[3] Enrollment estimates based on present study.

[4] Information not available

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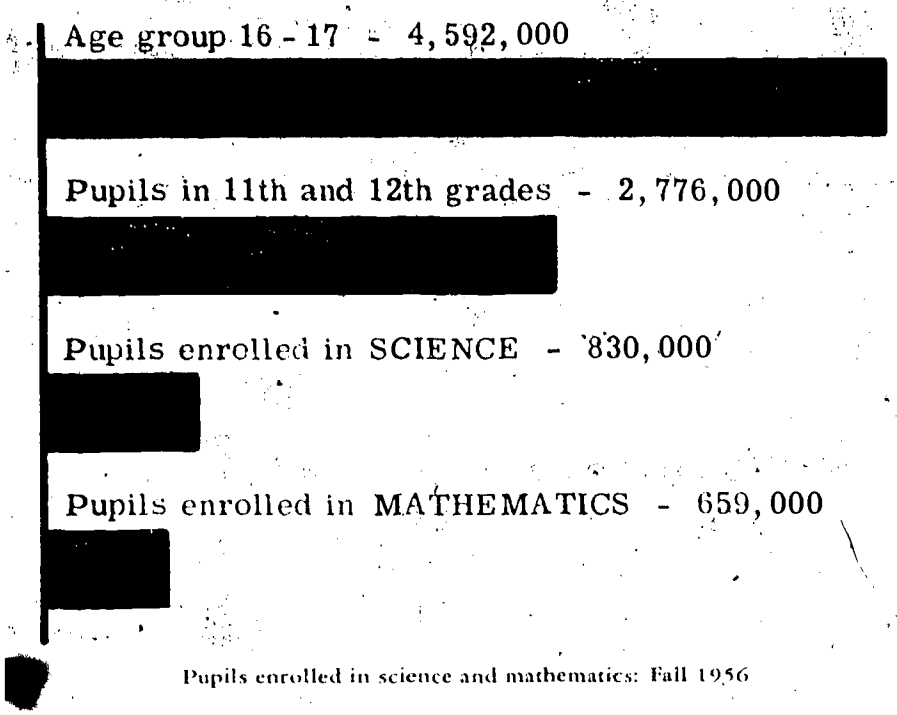

Pupils enrolled in science and mathematics: Fall 1956

MATHEMATICS & SCIENCE ENROLLMENT
PUBLIC HIGH SCHOOLS